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| 10/774,155      | 02/05/2004  | Rahul N. Manepalli   | 42P13856D           | 7283             |

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EXAMINER

DOLAN, JENNIFER M

ART UNIT PAPER NUMBER

2813

DATE MAILED: 03/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/774,155

Applicant(s)

MANEPALLI ET AL.

Examiner

Jennifer M. Dolan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 12-19 and 30-40 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 12-19 and 30-40 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 12/7/05
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

*This action is in response to the Amendment of December 5, 2005*

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 32 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 32 recites that the first substrate is the integrated circuit die and the second substrate is the package substrate. This does not correspond with the disclosure of the invention as well as the previous claims, which indicate that the first substrate is the package substrate and the second is the integrated circuit die. For example, claim 12 recites applying a molding compound over the second substrate (i.e. over the IC die as an overmolding) and applying another molding compound between the first and second substrates (as an underfill).

For the purpose of examination, it is assumed that the first substrate is the package substrate and the second is the IC die, such that it corresponds with the specification and the previously set forth claims.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 12, 13, 15, 18, 19, 31-33, and 35 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,324,069 to Weber.

Regarding claims 12, 15, 31, 33, and 35, Weber discloses providing a first substrate (14); predetermining a device placement location for a second substrate (12) to be coupled to the first substrate (column 5, lines 12-30; placement of bonding pads ‘predetermines’ the location of the second substrate); predetermining a flow modifier (29) height (‘D’; column 5, lines 30-36; figures 7, 7a); the height at least equal to the spacing between the substrates (figures 7, 7a); coupling the flow modifier to the first substrate substantially adjacent to the device placement location (figures 7, 7a; column 6, lines 22-30); coupling the second substrate to the first substrate (figures 7, 7a; column 6, lines 30-40); applying a first molding compound over the second substrate (16; portion extending across the sides and top of the second substrate; see figure 7a); and applying a second molding compound (16; portion underfilling the first substrate) between the first and second substrates (column 6, lines 20-27 shows separation of the molding regions), wherein the flow modifier substantially separates a flow of the first molding compound from a flow of the second molding compound (see column 6, lines 22-26; in the case of a continuous piece standoff with apertures to allow the underfill to flow under the chip, the flow must automatically be separated into at least two flow fronts, with one flowing over and around the top surface of the chip, and another flow front flowing through the apertures in the flow front modifier and under the chip, with the standoff piece providing a physical barrier between the two

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flows), where the first and second molding compounds are of an identical material and are introduced simultaneously (column 5, lines 35-50; column 6, lines 16-30).

Regarding claim 13, Weber discloses a flow modifier height within the claimed range (column 5, lines 30-35; figure 7a – flow modifier height = D).

Regarding claim 18, Weber discloses that the flow modifier is deposited before the substrates are coupled (see column 6, lines 1-30; flow modifier is attached to the underside of the chip before chip mounting).

Regarding claim 19, Weber discloses that the flow modifier is placed substantially around the device placement locations (column 6, lines 7-30).

Regarding claim 32, Weber discloses that the first substrate is a package substrate and the second substrate is an IC die (column 4, lines 50-60).

### ***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 12-17, 19, and 30-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,048,656 to Akram et al. in view of U.S. Patent Publication No. 2003/0042035 to Myers et al.

Regarding claims 12, 19, 30- 36, 38, and 40, Akram discloses a method comprising: providing a first substrate (100); predetermining a device placement location (by location of the

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contact pads on the substrate 100; see column 4, lines 32-40) for a second substrate (110) to be coupled to the first substrate (see figures 2 and 9); predetermining a flow modifier height at equal to or greater than a distance from the bottom of the second substrate to the top of the first substrate (column 5, lines 12-25); coupling a flow modifier to the substrate substantially adjacent to the device placement location (column 4, line 60 – column 5, line 45); coupling the second substrate to the first substrate at the device placement location (column 4, lines 30-60), and applying a second molding compound between the first substrate and the second substrate (column 5, line 60 – column 6, line 40), wherein the flow modifier substantially confines the flow of the second molding compound to the area between the first and second substrate and within the boundaries of the flow modifier, and wherein the flow modifier isolates the second molding compound from any overlying features (see figures 4 and 9).

Akram fails to disclose forming a molding compound over the second semiconductor substrate.

Myers teaches that it is common to apply an overmolding compound having the same composition as the underfilling compound, over and surrounding a flip chip in order to form a protective environmental seal around the device, as is notoriously old and well known in the art of semiconductor device packaging (also see paragraph 0006).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Akram, such that an overmolding compound having the same composition as the underfilling compound is applied over the second substrate, as is suggested by Myers. The rationale is as follows: A person having ordinary skill in the art would have been motivated to provide an overmolding compound over the second substrate, because doing so

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provides environmental protection for the integrated circuit chip package, as is well known to a person having routine skill in the art. A person skilled in the art would have used a compound having the same composition as the underfilling compound, because Myers shows that materials such as thermosetting polymers have suitable flow, protection, and thermal expansion properties to be used for both the underfilling material and the overmolding material (see Myers, paragraph 0022). It is noted that the flow modifier of Akram must automatically separate the underfilling molding from the overmolding, because it would be a physical barrier and seal between the two molding flows. It is further noted that the flow speed of a molding compound is directly related to the geometry of the area to be filled and the presence of suction elements to pull the molding compound. Since the underfilling and the overmolding would be applied to vastly different geometries, and since they would not use the same vacuum/suction for pulling the flow, it is expected that different flow speeds must result.

Regarding claim 13, Akram discloses that the flow modifier height can be approximately equal to the gap height (column 5, lines 5-25), and that the gap height intersects with the claimed range (see column 4, lines 60-64; gap height is 80-800 microns).

Regarding claim 14, Akram discloses applying low pressure over the substrates (column 6, lines 40-67).

Regarding claims 15-17, 37, and 39, Akram as modified by Myers discloses that the flow for underfilling is substantially isolated from any overmolding flows (see Akram, figure 9 – the underfilling material is dispensed through a hole in the first substrate and is fenced by the flow modifier material), and hence, such flows should be non-interfering. Akram, however, does not specifically teach a sequence of applying molding flows.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the molding compounds in the method of Akram as modified by Myers could be applied simultaneously or in any order. The rationale is as follows: A person having ordinary skill in the art would easily realize that the molding compounds could be applied in any order or simultaneously, because the underfilling and overmolding flows are separated by the flow modifier, and hence, would not interfere with each other. It has been held that selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results. *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946).

### ***Response to Arguments***

7. Applicant's arguments with respect to claims 12-19 and 30-40 have been considered but are largely moot in view of the new grounds of rejection.

Regarding the Weber reference: The Applicant essentially argues that Weber only has a single mold flow, and thus does not disclose separating a flow of a first molding compound from a flow of a second molding compound.

The Examiner disagrees with this characterization of Weber. Figures 12-15 clearly show that the flow front of the molding material starts at the side of the chip and substrate assembly (at inlet 44) and essentially flows from left to right in the figures. Hence, in the case where the continuous standoff having apertures is used, the flow front will split into two flows at the left side of the chip: one flowing through the aperture and under the chip, and a second flow passing over the top of the chip. The Examiner notes that this embodiment of Weber is not dissimilar to



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that disclosed by the Applicant in paragraph 0019, wherein a single flow front is separated into two mold flows upon reaching the flow front modifier.

***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

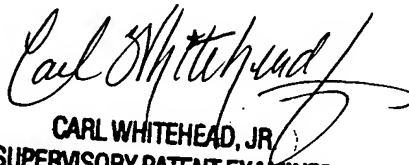
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan  
Examiner  
Art Unit 2813

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